DOCUMENT RESUME

ED 124 504 SP 010 080

AUTHOR Gilley, Daryl V.; French, Russell L.
TITLE Personal Learning Styles: Exploring the Individual's Sensory Input Processes.
PUB DATE 76
NOTE 29p.; Paper presented at the annual meeting of the American Educational Research Association (San Francisco, California, 1976)

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Academic Achievement; Elementary Education; Grade 3; High Achievers; *Learning; *Learning Modalities; Learning Processes; Low Achievers; *Sensory Experience; *Students
IDENTIFIERS MMPALT; Multi Modal Paired Associates Learning Test; Tennessee (Knoxville)

ABSTRACT

This study identified a set of six theoretical styles of learning which have as their base the individual's preferential sensory input mode. Styles involved in the study were based upon the visual, aural, haptic, interactive, print, and kinesthetic modalities. A multi-modal paired associates learning test (MMPALT) was used to determine the subject's preferred sensory input mode. The sample population consisted of 24 third-grade children from five Knoxville City Elementary Schools in Knoxville, Tennessee. Subjects who had been previously classified as high achievers or low achievers, based upon their score on the total reading and total mathematics sections of the Comprehensive Test of Basic Skills, were administered the six sections of the MMPALT. Using the analysis of variance technique, it was found that: (1) children did receive and process information with different degrees of efficiency; (2) significant differences existed between children of different achievement levels; (3) significant differences existed between children of similar achievement levels; (4) the variable of sex was found to be nonsignificant; (5) significant differences existed between modes of information input; and (6) each child possessed a different hierarchial alignment of preferred sensory input modes. (Author)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED124504

PERSONAL LEARNING STYLES: EXPLORING THE INDIVIDUAL"S SENSORY INPUT PROCESSES

by

Daryl V. Gilley

Russell L. French

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL HAS BEEN GRANTED BY

Daryl V. Gilley

TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE NATIONAL INSTITUTE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER."

SP010 080

Prepared for the Annual Meeting of The American Educational Research Association, Session Number 5.05, San Francisco, California, 1976.

Gilley, Daryl V. Personal Learning Styles: Exploring The Individual's Sensory Input Processes, Knoxville; Paper Presented at American Educational Research Association, April 20, 1976.

The purpose of this study was to identify a set of six theoretical styles of learning which have as their base, the individual's preferential sensory input mode. Styles involved in the study were based upon the visual, aural, haptic, interactive, print and kinesthetic modalities. A multi-modal paired associates learning test was used to determine the subject's preferred sensory input mode.

The sample population consisted of 24 third grade children from five Knoxville City Elementary Schools, in Knoxville, Tennessee. Subjects who had been previously classified as high achievers or low achievers, based upon their score on the total reading and total mathematics sections of the Comprehensive Test of Basic Skills, were administered the six sections of the M.M.P.A.L.T.

Using the analysis of variance technique, it was found that:

A. Children did receive and process information with different degrees of efficiency.
B. Significant differences existed between children of different achievement levels.
C. Significant differences existed between children of similar achievement levels.
D. The variable of sex was found to be nonsignificant.
E. Significant differences existed between modes of information input.
F. Each child possessed a different hierarchical alignment of preferred sensory input modes.

SP 010 080

PURPOSE OF THE STUDY

The purpose of this study was to assess the validity of six, theoretical styles of learning which have as their base the individual's dominant sensory input mode. These styles proposed by French (1975) include:

1.	Visual	Must have visual stimuli and visual representation.
2.	Aural	A listener; doesn't say much.
3.	Haptic	Has to touch everything and everyone.
4.	Interactive	A talker; learns through discussion.
5.	Print	Dependence on reading as input and writing as output.
6.	Kinesthetic	A motor learner; has to move about while learning.

Questions posed by the investigators as guides to the study included the following:

A. Do individual children possess a single dominant style of learning?

B. Do individual children possess multiple dominant styles of learning?

C. Do personal learning styles vary with the achievement level of the child?

D. Do personal learning styles vary with the sex of the child?

PROCEDURES

DEVELOPMENT OF THE MULTI-MODAL PAIRED ASSOCIATES LEARNING TEST

An instrument was needed which could measure a subject's ability to receive and process information, via the six sensory modalities mentioned earlier. It was necessary that the instrument be equally applicable to each of the modalities under investigation.

After reviewing a number of tests and testing paradigms, the paired associate technique was chosen as the model from which to develop the

instrument. Because of 1) the wide acceptance and utilization of the paired associate technique in the study of verbal learning and 2) the ease with which it could be, and has been, applied to other modes of communication research, it was deemed an appropriate procedure.

For this study, a multi-modal paired associate test was developed. It consisted of six sections, corresponding to the six modalities under investigation. The Multi-Modal Paired Associates Learning Test (MMPALT) was based upon the anticipation technique as described by Marx (1970) and Battig (1962).

The assessment of each modality (section) focused on the subject's ability to receive and process information via the specific modality being investigated. For example, in investigating the visual modality only 35mm. color slides were used. In investigating the aural modality the only information received by the subject was the sound of the examiner's voice. The other four modes of investigation were similarly restrictive concerning the nature of the information received by the subject.

Selection of Subjects

The investigators selected as a potential population third grade children enrolled in elementary schools in Knoxville, Tennessee. In order to assure diversity of subjects, two target schools were selected from lower socioeconomic areas; two schools were selected from high socioeconomic areas; and one target school was chosen from an area of multiple socioeconomic strata.

All potential subjects in these target schools then were grouped on the basis of a national percentile ranking (N.P.R.) as determined by total scores on the reading and mathematics sections of the Comprehensive Test

of Basic Skills (M-S, Level 1, Form Q, Booklets 1 and 2). All subjects who achieved an N.P.R. of 70 and above in both total reading and total mathematics were placed in the above average group. Subjects who achieved an N.P.R. of 40 or below in both total reading and total mathematics were placed in the below average group. Grouping was done as an administrative procedure only. At no time were the subjects aware of any grouping situation.

Each potential subject in the population then was assigned a number and a table of random numbers (Edwards, 1972) was then used to select the sample from sixty subjects. Within this total population of sixty, four subpopulations were identifiable. Males with an N.P.R. of 70 or above numbered eighteen. Males with an N.P.R. of 40 or below numbered twenty-one. Females with an N.P.R. of 70 or above numbered fourteen, and females with an N.P.R. of 40 or below numbered seven.

To attain a final sample of twenty-four (24) subjects, seven subjects (one to be used as an alternate) were randomly selected from each of the four subpopulations.

Two other criteria were used in the selection process. All subjects were required to meet minimum acceptable standards of hearing and visual acuity as determined by the school health service of the Knoxville City School System. A corrected visual or auditory defect was permitted as long as the subject's corrected vision and hearing were deemed normal.

Administration of the MMPALT

The entire testing process required six administrators each working six full days or 216 clock hours. (The school day lasted from 8:30 A.M. until 3:00 P.M.). Testing was completed for each subject during one school

day. The test was administered by six students from the University of Tennessee. The examiners were both male and female and were involved in two training sessions of one and three hours each. Each examiner was provided with typewritten instructions which he/she followed explicitly. All examiners were continuously supervised to ensure continuity of procedure. Each examiner adhered strictly to the following procedural guidelines:

1. All information was input via the modality under investigation, with the exception of the practice set, during which explanations and questions were allowed.
2. All responses, correct or incorrect, were followed by a presentation of the appropriate stimulus pair.
3. Approximately seven seconds were allowed for the subject to respond to the stimulus member of the paired items.
4. Each subject was given the opportunity of one practice set before each section of the test.
5. Each subject was presented with a familiarization trial prior to the response trials for each set, of each modality of the test.
6. Each subject was tested through three sets in each section.
7. During the practice set, three correct responses were considered evidence of the fact that the subject understood the procedure.

To allow for a practice effect; that is the improvement of a subject's performance over trials, all of the subjects were administered the various sections of the test in a random order. The randomization of test sections was accomplished by the use of a table of random numbers (Edwards, 19[illegible]). The randomization procedure also compensated for the effect of physical and emotional fatigue and frustration, which was not anticipated, but which did play an important, observable role in the subject's performance. The order of test performance is presented in Table 1.

TABLE 1

RANDOM ORDER OF TREATMENTS FOR PRACTICE EFFECT

N.P.R.	Sex	S	T1	T2	T3	T4	T5	T6
		1	P	V	H	K	A	I
70	M	2	A	P	I	I	V	K
AND	A	3	I	V	H	A	K	P
ABOVE	L	4	P	A	I	V	K	H
	E	5	H	P	A	K	V	I
		6	K	I	P	H	A	V
	F	7	V	H	K	I	P	A
70	E	8	A	K	V	P	I	H
AND	M	9	V	A	K	P	I	H
ABOVE	A	10	P	A	I	V	H	K
	L	11	I	H	K	P	A	V
	E	12	V	A	I	P	H	K
		13	A	K	V	H	I	P
40	M	14	V	P	I	K	H	A
AND	A	15	I	V	A	K	H	P
BELOW	L	16	V	H	I	P	K	A
	E	17	I	V	H	A	P	K
		18	K	A	V	H	P	I
	F	19	I	V	A	K	H	P
40	E	20	A	H	I	V	P	K
AND	M	21	H	P	I	A	V	K
BELOW	A	22	K	I	V	A	H	P
	L	23	I	V	H	A	K	P
	E	24	A	K	V	I	E	P

*N P.R.: National Percentile Ranking

**Subjects

Treatment of Data

Each subject produced three scores, for each of the six sections of the M.M.P.A.L.T. From these three scores, a mean score was derived for each student for each of the six sections of the test. Therefore, six mean scores were derived for each subject. Individual mean scores for all of the subjects are presented in Table 2.

FINDINGS

Individual Differences

This study proposed that children possess personal styles of learning which have as their base preferential modes of information input, and that those modes are sensory in nature. A graphic representation of each subject's performance on the M.M.P.A.L.T. is presented in figures 1-8. By inspecting this series of graphs it may be seen that, even though most of the subjects performed well in two of the modalities, the visual and the haptic, no two subjects performed exactly the same across all six modalities. For example, on the haptic section of the test a mean score of all subjects' performance was found to be 2.68 trials to mastery. However, two subjects (12 and 17) both produced scores of 4.0. A similar statement may be made concerning the second most effective modality for the total sample. On the visual section of the test the mean score for all subjects was 3.1 trials to mastery. However, two subjects (15 and 23) produced scores of 5.3 and 5.0 respectively. Even though this information was not statistically significant, it did point up the fact that at least four subjects differed considerably from the sample population in regard to their two most effective modes of information input. A review of figures 1-8 also indicates that most subjects possessed multiple effective styles of learning, but a few children possessed

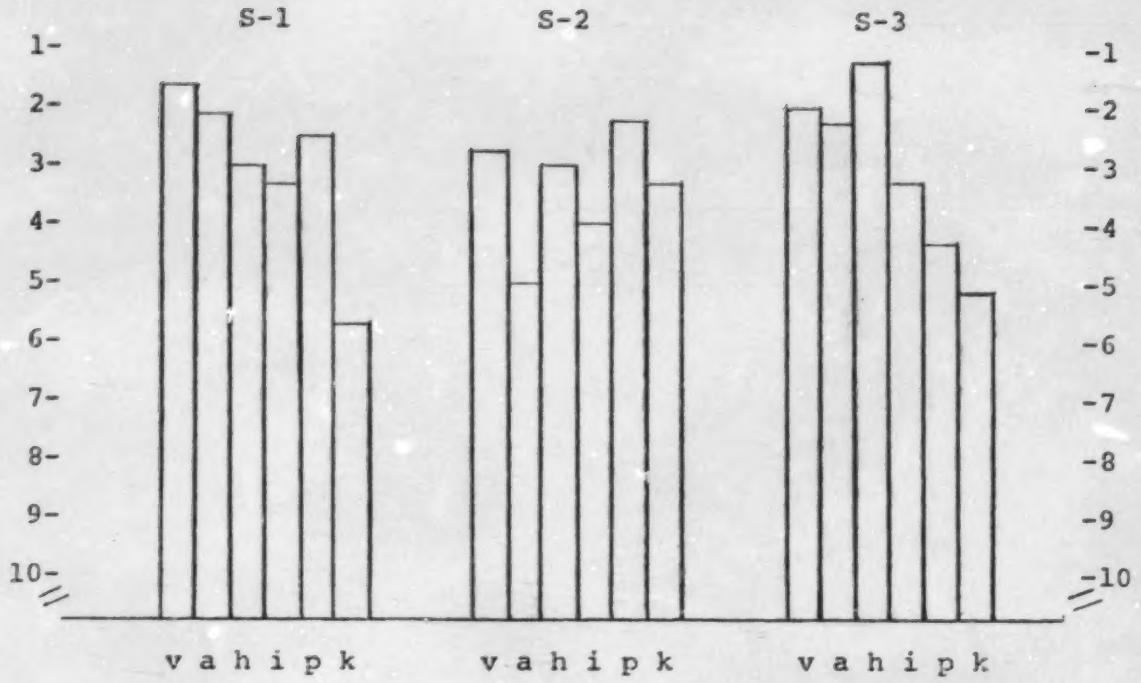
TABLE 2

MEAN SCORE PER SUBJECT

			Sensory Modalities					
N.P.R.*	Sex	S**	V	A	H	I	P	K
		1	1.7	2.3	3.0	3.3	2.7	5.7
70	M	2	2.7	5.0	3.0	4.0	1.7	3.3
AND	A	3	2.0	2.3	1.3	3.3	4.3	5.0
ABOVE	L	4	4.0	3.3	1.7	2.7	2.7	4.0
	E	5	2.3	2.7	2.7	6.0	3.0	4.7
		6	3.7	5.3	3.0	7.0	6.3	4.7
	F	7	4.3	3.0	2.7	5.3	4.7	5.0
70	E	8	2.3	3.0	3.7	4.0	3.3	5.0
AND	M	9	3.0	5.0	2.7	7.7	2.7	4.3
ABOVE	A	10	3.7	3.7	2.3	4.7	4.7	4.3
	L	11	2.3	3.7	3.0	3.0	3.0	5.7
	E	12	2.3	.13	4.0	6.0	5.7	4.3
		13	2.0	4.7	2.0	3.0	4.3	3.7
40	M	14	4.3	5.3	3.7	10.0	9.0	5.0
AND	A	15	5.3	4.3	3.0	5.3	5.7	4.3
BELOW	L	16	3.3	3.0	2.3	9.3	7.3	3.7
	E	17	4.0	7.7	4.0	5.3	7.0	8.0
		18	3.3	7.3	3.3	8.3	10.0	4.3
	F	19	2.0	2.7	2.7	10.0	7.10	2.3
40	E	20	2.3	5.3	3.0	3.3	9.0	3.3
AND	M	21	2.7	7.0	2.0	7.7	7.3	2.7
BELOW	A	22	2.7	1.0	1.3	8.0	6.3	4.7
	L	23	5.0	1.0	2.0	7.0	5.7	2.7
	E	24	4.0	9.3	2.0	8.3	10.0	2.7

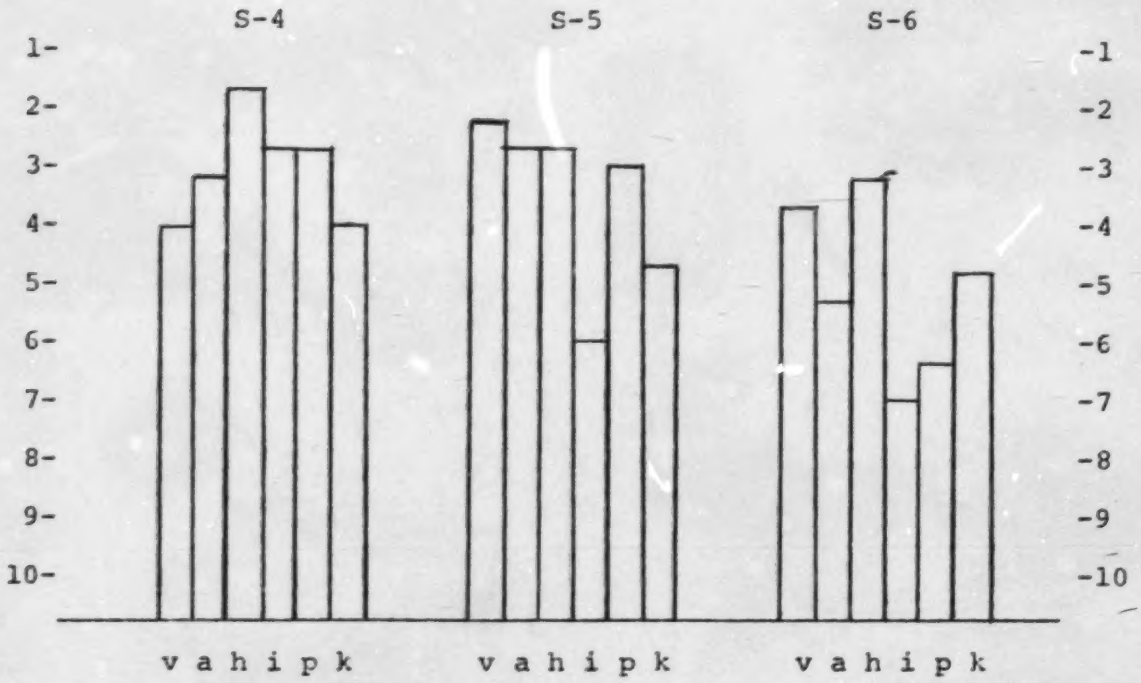
*N.P.R.: National Percentile Ranking

**Subjects



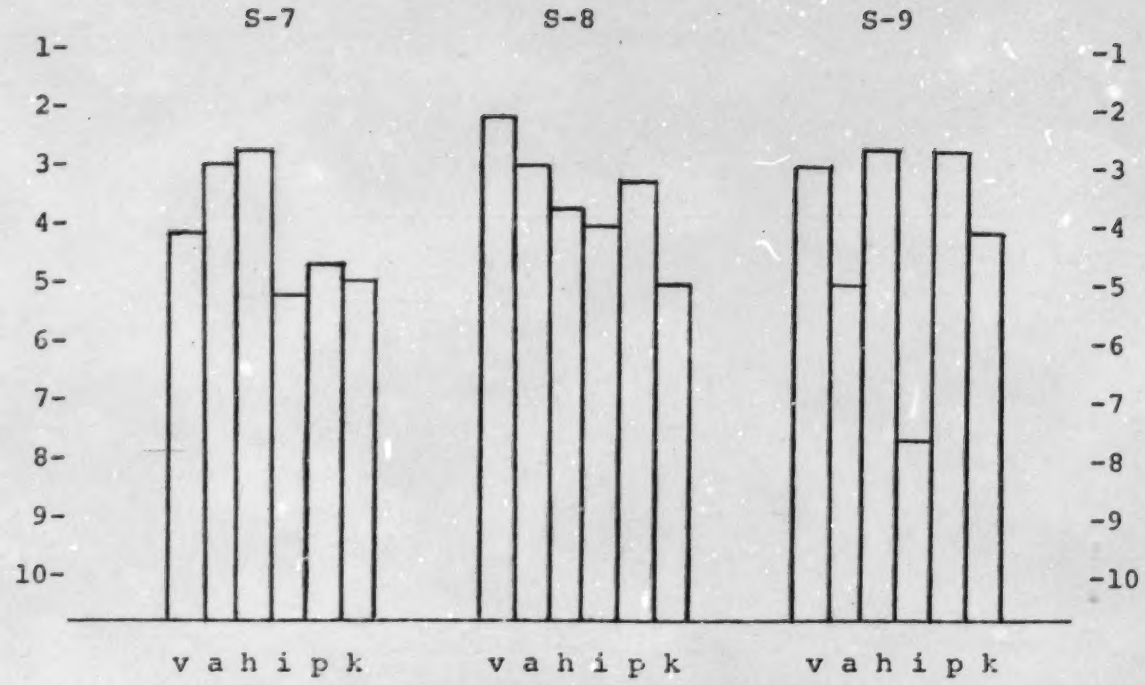
S=Subject

Figure 1. Mean performance for Six Sensory Modalities, S-1, S-2, and S-3.



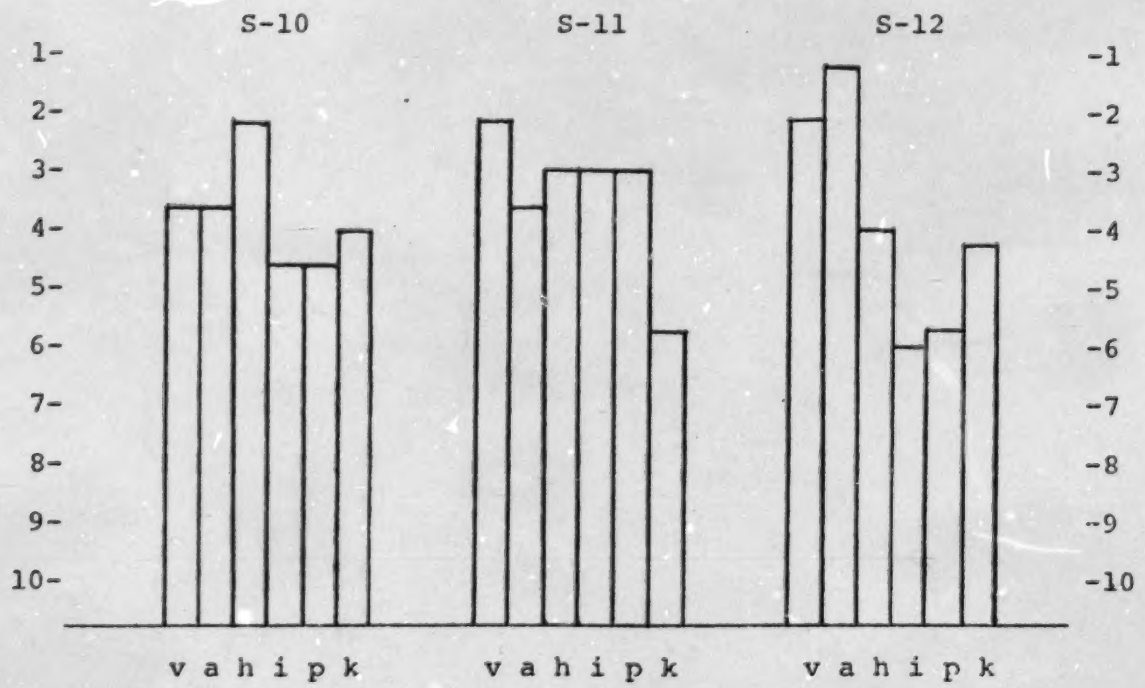
S=Subject

Figure 2. Mean performance for Six Sensory Modalities, S-4, S-5, and S-6



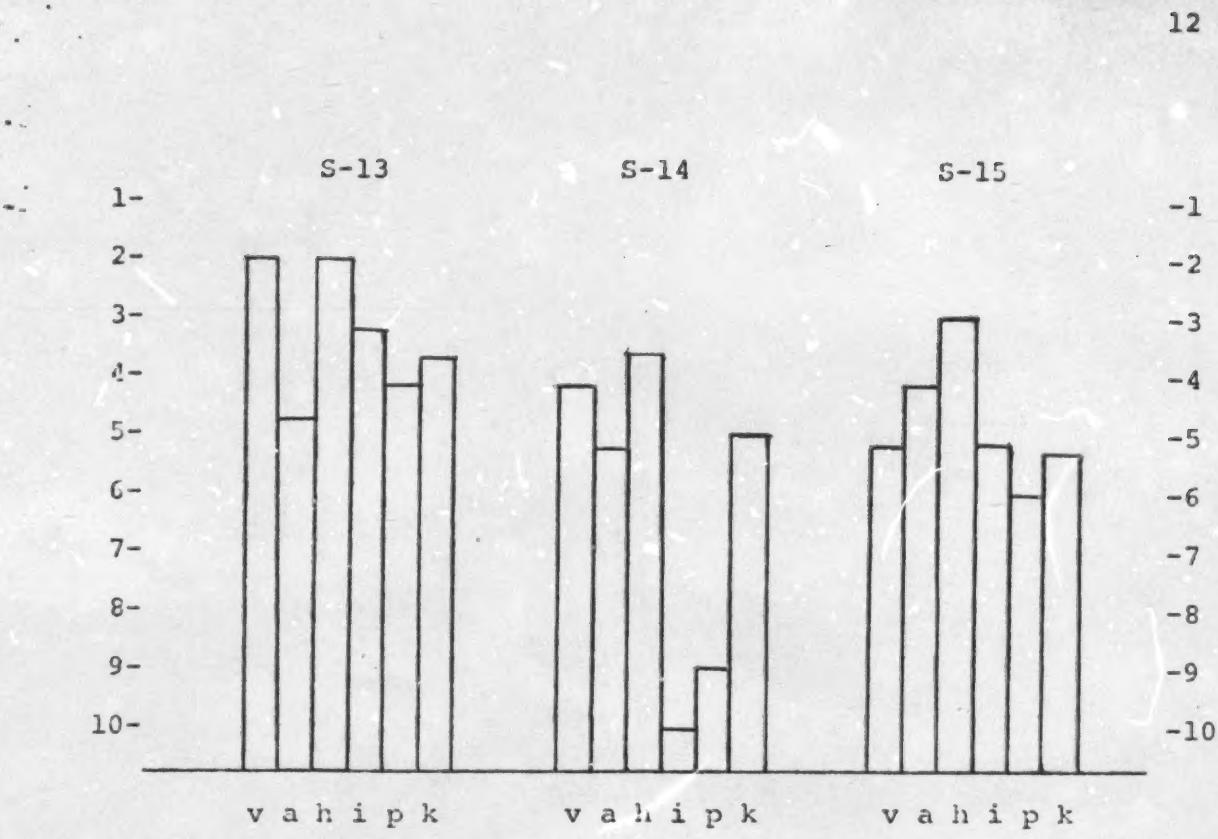
S=Subject

Figure 3. Mean performance for Six Sensory Modalities, S-7, S-8, and S-9.



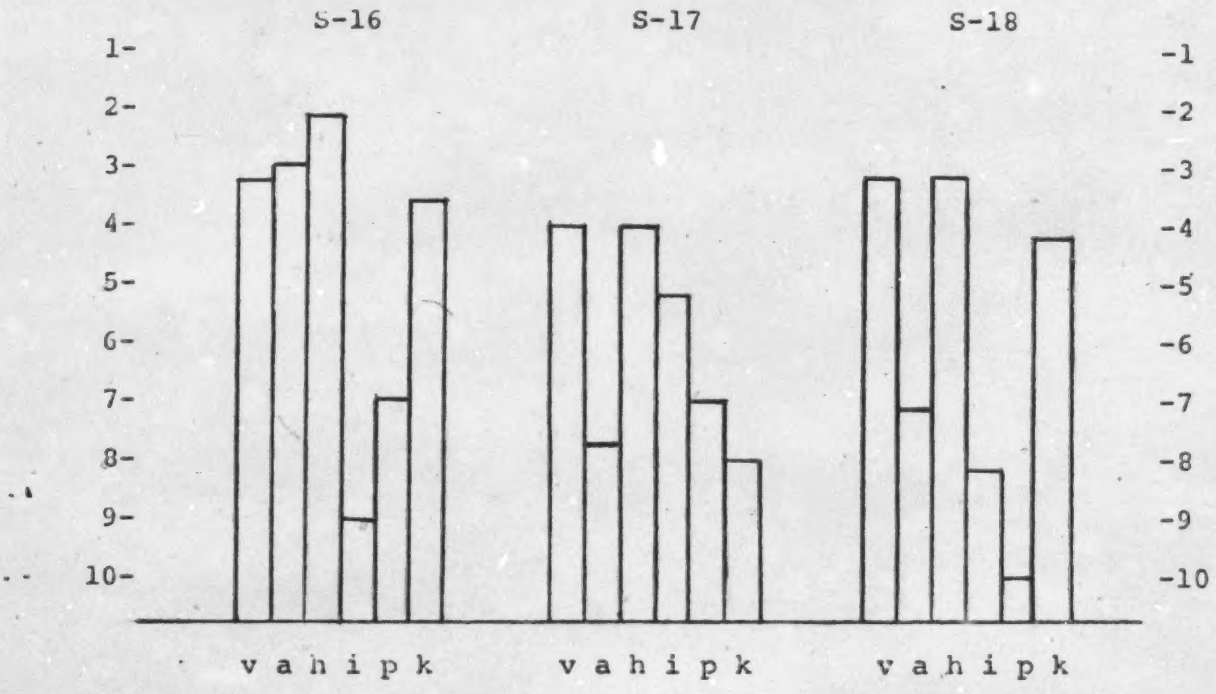
S=Subject

Figure 4. Mean performance for Six Sensory Modalities, S-10, S-11, and S-12.



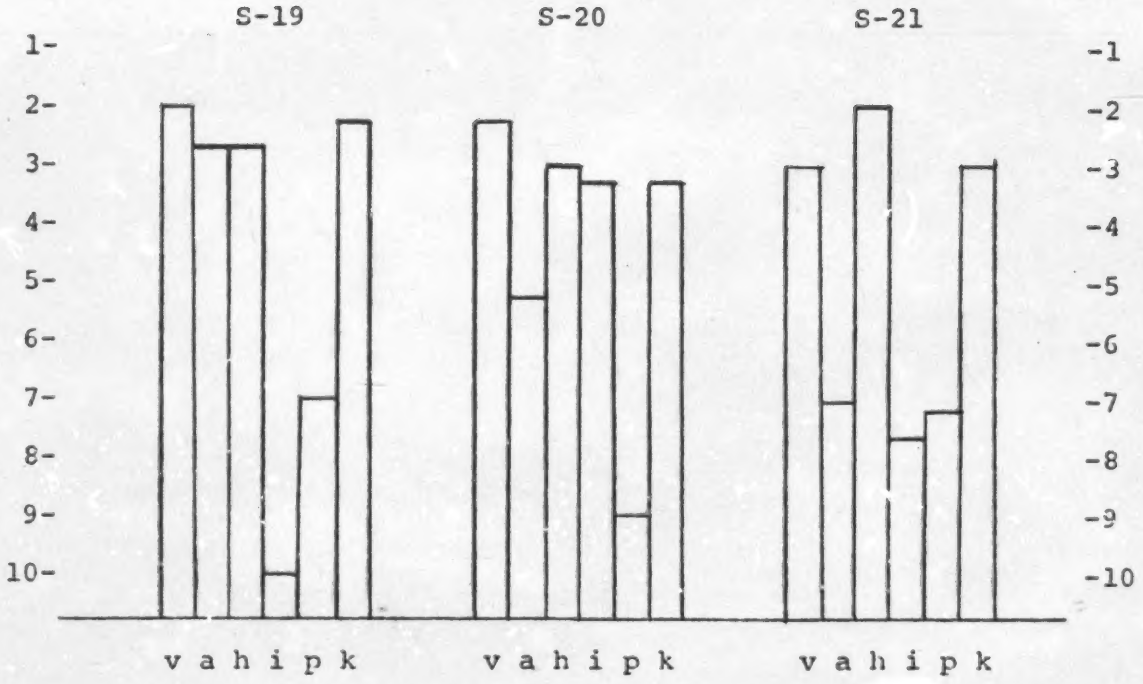
S=Subject

Figure 5. Mean performance for Six Sensory Modalities, S-13, S-14, and S-15.



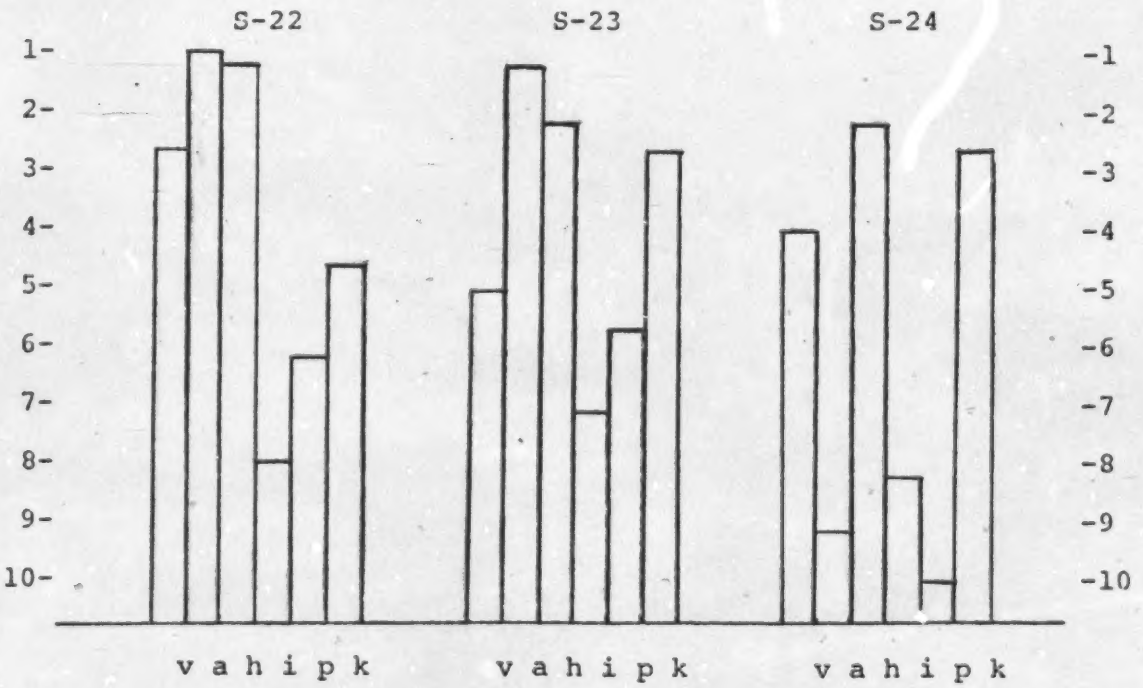
S=Subject

Figure 6. Mean performance for Six Sensory Modalities, S-16, S-17, and S-18.



S=Subject

Figure 7. Mean performance for Six Sensory Modalities, S-19, S-20, and S-21.



S=Subject

Figure 8. Mean performance for Six Sensory Modalities, S-22, S-23, and S-24.

a single dominant style.

Hierarchical Alignment

By inspecting Table 3 it may be seen that each subject had a unique hierarchical alignment of learning styles. In Table 3, the upper case letters represent the sensory modality while the numerals in parenthesis represent the mean number of trials each subject required to master the set. By inspection, the reader may also determine the subject's numerically strongest modality and numerically weakest modality. For example, subject number one demonstrated a variance in efficiency ranging from 1.7 trials to mastery in the visual modality to 5.7 trials to mastery in the kinesthetic modality.

Group Differences

Using the Lindquist type III, repeated measures, analysis of variance design (Kirk, 1968; Huck, Cormier and Bounds, 1974) the data were analyzed for significant differences between sex, high achievers, low achievers, (based on national percentile rankings in reading and mathematics) and treatments. The summary table for the analysis of variance is presented in Table 4.

Three of the F scores were found to be significant at the .01 level of confidence. Based upon these data, there was indication that significant differences did exist between achievement levels (N.P.R.), within treatments (modalities) and within the first order interaction of treatments by N.P.R. Since both of these variables, treatments and N.P.R., were involved in the two way interaction, only that interaction was interpreted.

A graph of that interaction may be found in Figure 9. The graph

TABLE 3

SENSORY MODALITIES AND MFAN SCORE

S*	1	2	3	4	5	6
1	V(1.7)	A(2.3)	P(2.7)	H(3.0)	I(3.3)	K(5.7)
2	P(1.7)	V(2.7)	H(3.0)	K(3.3)	I(4.0)	A(5.0)
3	H(1.3)	V(2.0)	A(2.3)	I(3.3)	P(4.3)	K(5.0)
4	H(1.7)	I(2.7)	P(2.7)	A(3.3)	K(4.0)	V(4.0)
5	V(2.3)	A(2.7)	H(2.7)	P(3.0)	K(4.7)	I(6.0)
6	H(3.0)	V(3.7)	K(4.7)	A(5.3)	P(6.3)	I(7.0)
7	H(2.7)	A(3.0)	V(4.3)	P(4.7)	K(5.0)	I(5.3)
8	V(2.3)	A(3.0)	P(3.3)	H(3.7)	I(4.0)	K(5.0)
9	H(2.7)	P(2.7)	V(3.0)	K(4.3)	A(5.3)	I(7.7)
10	H(2.3)	V(3.7)	A(3.7)	K(4.3)	I(4.7)	P(4.7)
11	V(2.3)	H(3.0)	I(3.0)	P(3.0)	A(3.7)	K(5.7)
12	A(1.3)	V(2.3)	H(4.0)	K(4.3)	P(5.7)	I(6.0)
13	V(2.0)	H(2.0)	I(3.3)	K(3.7)	P(4.3)	A(4.7)
14	H(3.7)	V(4.3)	K(5.0)	A(5.3)	P(9.0)	I(10.0)
15	H(3.0)	A(4.3)	K(4.3)	V(5.3)	I(5.3)	P(5.7)
16	H(2.3)	A(3.0)	V(3.3)	K(3.7)	P(7.3)	I(9.3)
17	V(4.0)	H(4.0)	I(5.3)	P(7.0)	A(7.7)	K(8.0)
18	H(3.3)	V(3.3)	K(4.3)	A(7.3)	I(8.3)	P(10.0)
19	V(2.0)	K(2.3)	A(2.7)	H(2.7)	P(7.0)	I(10.0)
20	V(2.3)	H(3.0)	I(3.3)	K(3.3)	A(5.3)	P(9.0)
21	H(2.0)	V(2.7)	K(2.7)	A(7.0)	P(7.3)	I(7.7)
22	A(1.0)	H(1.3)	V(2.7)	K(4.7)	P(6.3)	I(8.0)
23	A(1.0)	H(2.0)	K(2.7)	V(5.0)	P(5.7)	I(7.0)
24	H(2.0)	K(2.7)	V(4.0)	I(8.3)	A(9.3)	P(10.0)

*Subjects

TABLE 4

SUMMARY TABLE ANALYSIS OF VARIANCE FOR ALL VARIABLES

Source	DF	Sum of Squares	Mean Square	F
Between S.				
Sex	1	.370	.370	.096
N.P.R.	1	51.960	51.960	13.426**
Sex X N.P.R.	1	7.981	7.981	2.062
Error B.	20	77.399	3.870	
Within S.				
Treatments (Modalities)	5	199.305	39.861	18.908**
Treatments X Sex	5	8.944	1.789	.848
Treatments X N.P.R.	5	80.620	16.124	7.648**
Treatments X Sex X N.P.R.	5	3.510	.702	.333
Error W.	100	210.819	2.108	
Total	143	640.908	4.482	

*p. < .05

**p. < .01

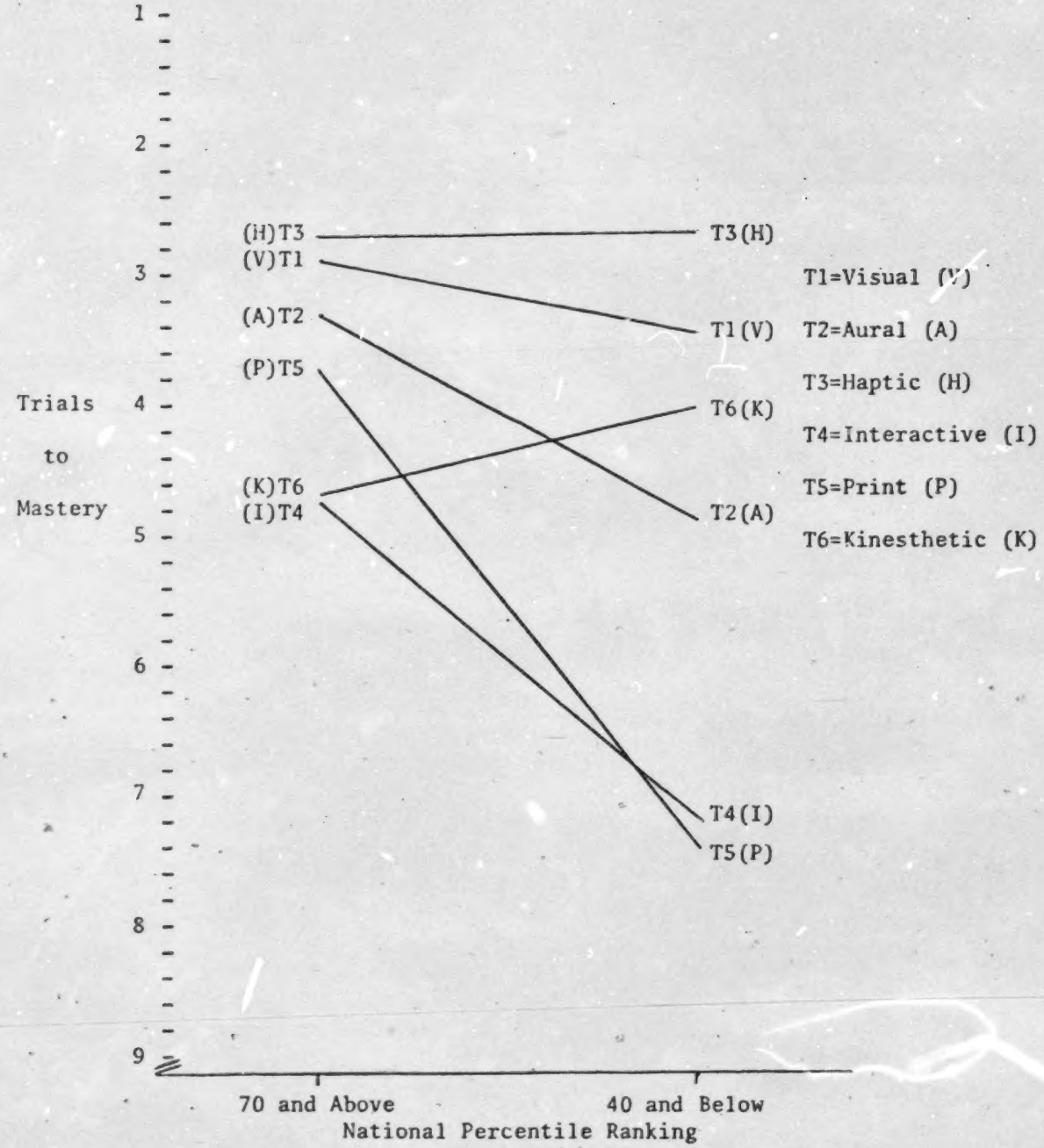


Figure 9. Mean Score for All Treatments (Modalities).

suggests that for both high achievers and low achievers, the haptic and visual sensory modalities proved to be the most efficient. These two modalities were represented as treatments three and one respectively. However, the alignment of the remaining four modalities for high achievers and low achievers was quite different. For the high achievers the remaining modes, in the order of their efficiency were: arual, print, kinesthetic and interactive. For the low achievers the remaining modes, in the order of their efficiency were: kinesthetic, aural, interactive and print. Further comparison points up the fact that low achievers performed slightly better than high achievers in the haptic mode and a great deal better in the kinesthetic mode. Low achievers produced a mean score of 2.61 trials to mastery as compared with a mean score of 2.76 trials to mastery for the high achievers on the haptic modality. On the kinesthetic modality the differences were greater. Low achievers produced a mean score of 3.95 compared to the score of 4.67 produced by the high achievers. In all other modes the low achievers performed less efficiently than their high achieving counterparts. In order to gain a better understanding of that interaction, a post hoc analysis was completed.

Tests for Simple Main Effects

The summary information for the test of simple main effects (N.P.R.) is presented in Table 5. By inspection it is apparent that there were significant differences at both the achievement level of 70 and above (significant at .05) and at the achievement level of 40 and below (significant at .01).

It should be noted at this point that the Geiser-Greenhouse effect for conservative degrees of freedom was employed on this test of simple main

TABLE 5

SUMMARY TABLE FOR ANOVA COLLAPSED ACROSS SEX, MAIN EFFECT=N.P.R.

Source	DF	Sum of Squares	Mean Square	F
Modality at a N.P.R. of 70 or Above	5	44.605	8.921	4.232*
Modality at a N.P.R. of 40 of Below	5	194.959	38.992	18.497**
Error	100	210.819	2.108	

*p. < .05

**p. < .01

Note: The Geiser Greenhouse effect for conservative degrees of freedom was employed when determining the critical values for F. Conservative degrees of freedom=1/20.

effects (Kirk, 1968, p. 262). The purpose for using the Geiser-Greenhouse procedure was to strengthen the test of simple main effects. Since the Geiser-Greenhouse procedure assumes that the assumption of homogeneity has been drastically violated, it increases the power of a test where that assumption has been met.

Thus to summarize the post hoc analysis for N.P.R., the data indicated a significant difference within the high achievement group. The computed F was found to be significant at the .05 level of confidence. The data also indicated a significant difference within the low achievement group. The computed F was found to be significant at the .01 level of confidence.

Summary

To summarize the data presented, it was found that:

A. Children did receive and process information with different degrees of efficiency.

B. Significant differences did exist between children of different achievement levels.

C. Significant differences did exist between children of similar achievement levels.

D. The variable of sex was found to be nonsignificant.

E. Each child possessed a different hierarchical alignment of preferred sensory input modes.

F. Over all, the most efficient means of inputting information to both high achievers and low achievers was the haptic mode.

G. Over all, the second most efficient means of inputting information to both high achievers and low achievers was the visual mode.

H. The hierarchical alignment of preferred information input modes for high achievers was:

    1. Haptic

    2. Visual

3. Aural

4. Print

5. Kinesthetic

6. Interactive

I. The hierarchical alignment of preferred information input modes for low achievers was:

1. Haptic

2. Visual

3. Kinesthetic

4. Aural

5. Interactive

6. Print

CONCLUSIONS AND IMPLICATIONS

The assumption upon which the study was based, that individuals receive and process information differently, was substantiated. The figures on pages 10 - 13 provide visual support for the assumption that no two children have exactly the same hierarchical alignment of styles. It was also found that in those two modalities where a majority of the subjects seemed to perform well, variance in efficiency still existed.

Questions initially posed and answered by the findings were as follows:

1. Do third grade children possess a single dominant style of learning? Concerning the group as a whole, the data indicated that the answer was in the affirmative. Among all subjects, high achievers and low achievers, the most effective means of information input was through the haptic modality. Subjects classified as low achievers seemed to perform slightly better than did the high achievers in this modality. Low achieving subjects required

a mean number of 2.61 trials to master the haptic modality whereas high achievers required a mean number of 2.76 trials to master the same material. It should be noted, however, that not all of the subjects preferred the haptic modality. Completed hierarchical alignments for each subject were presented in Table 3. As the data related to individual children, the answer to question number one was, some children do possess a single dominant style of learning.

2. The question, "Do third-grade children possess multiple dominant styles of learning?" was answered in the affirmative for individuals and in the negative for groups. Referring to Figures 1-8, it may be seen that many subjects scored equally well on various sections of the test. However, there was no pattern to suggest that all individuals shared the same multiple dominant styles of learning. Concerning the group as a whole, it could be argued that scores on the haptic modality and the visual modality were not significantly different from each other and that combined, those modes resulted in a multiple dominant style.

3. The question, do personal learning styles vary with the sex of the child, was answered in the negative. No differences were found to be associated with sex on any section of the M.M.P.A.L.T.

4. The question, do personal learning styles vary with the achievement level of the child, was answered in the affirmative. The analysis of variance test for achievement was found to be significant at the .01 level of confidence. Testing for simple main effects, the analysis of variance indicated that significant differences were evident among the high achievers as well as the low achievers.

Within the constraints of this study the data seemed to justify the following conclusions.

1. Third grade children, identified as high achievers and low achievers, do receive and process information with different degrees of efficiency across the six sensory modalities.

2. In general, the information presented haptically was received and processed with greater efficiency than was information presented in any of the other modes.

3. As a group, both high achievers and low achievers preferred the haptic and visual modalities over the other four modes of information input.

4. The high achievers received and processed information at a significantly different rate of efficiency than the low achievers.

5. Sex was not a factor in the information input efficiency and sensory modality.

6. Children of low achievement levels receive and process information with different degrees of efficiency across the six modalities.

7. Children of high achievement levels receive and process information with different degrees of efficiency across the six modalities.

Implications

The test of simple main effects for achievement levels demonstrated significant differences within the high achievement group and the low achievement group. This finding produces a most important implication, for it refutes the assumption of commonality of learning style discussed earlier in this paper. It also refutes the often held assumption of commonality of style within an achievement level. Simply, this finding suggests that a child does not necessarily share the same personal learning style with all other children found to be within his/her achievement range. For too long,

educators have identified children as slow or gifted based upon their performance on standardized achievement tests. But "slowness" or "giftedness" may be more a manifestation of learning style than one of achievement or ability. It now seems quite possible, as Calvin Taylor (1974) has suggested, that potentially all children are gifted. This finding should be reflected in classroom instruction. Varied learning experiences at all ability levels must become the rule, not the exception.

As a group, the total sample of twenty-four third grade children seemed to possess a single dominant style of learning--the haptic style. However, the style orientations of individuals varied. Some individuals did possess a single dominant style, but a greater number demonstrated multiple dominant styles. If we assume that successful experience in the world at large demands an integrated, multi-sensory approach to information-gathering and processing, we are confronted with the question of facilitating the individual's growth in modalities other than his/her dominant one(s). Education has given little thought to the structuring of activities and experiences to this end.

Does an individual maintain dominance in a learning style (or specific combination of styles) throughout life? Or, do different styles achieve dominance at different stages of human development? How does the individual's modality preference correspond with his/her modality utilization? These questions and others remain unanswered by this investigation? Many additional studies are needed before we can maximize the use of the data thus far available. If, indeed, modality preference and use changes in some patterned alignment from infancy through adulthood, the implications

are staggering. Such information would allow for a more precise diagnostic approach in the area of learning disabilities. It could probably serve as a catalyst to improve a child's capacity to learn in several modalities. (For example, the haptic or kinesthetic modes might serve as bridges to the print or oral modalities.) Obviously, such information would be of considerable value to educators involved in instructional design at all levels of the educational process.

Many more implications of this investigation must remain in the form of questions for the time being. For example, if learner styles differ, do teaching styles also differ as a reflection of the teacher's learning style? If so, would children perform more effectively working with a teacher whose learning style is compatible? Would it be most helpful for a learner to work with other learners whose styles are similar or with those whose styles are different?

During the testing process, it became evident that children from low socioeconomic backgrounds produced low scores in the print and interactive modalities. It may be hypothesized that home environment is a determining factor in the development of learning styles. However, there is presently little research into this relationship. Why <u>do</u> children from a specific cultural background perform well in one sensory modality and poorly in another?

Finally, we must remind the reader that learning style may be multi-dimensional. This investigation has focused on sensory modalities. A survey of the research and theory presently available in areas such as cognition suggests that the assessment of one's total learning style may mean locating the intersections or correlations of the individual's

approach in several dimensions.

In the final analysis, it can be concluded that children do receive and process information differently, and that sensory input plays some significant part in the learner's approach or personal learning style. Much more information is needed, but several directions for investigation are now clear.

BIBLIOGRAPHY

Bahner, John M. and Charles L. Willis. "Selected Concepts for Individually Guided Instruction," Theory Into Practice. XIII (2), April, 1974, pp. 97-102.

Barsch, Ray H. Achieving Perceptual Motor Efficiency A Space Oriented Approach to Learning, Vol. 1, Seattle, Washington: Special Child Publications, 1968.

Battig, William F. Analysis of Processes in Paired-Associates Learning, Cooperative Research Project No. 730, Charlottsville, Virginia: 1962.

Birch, Herbert G. "Dyslexia and the Maturation of Visual Function," Reading Disability, John Money Editor, Baltimore: The John Hopkins Press, 1967, pp. 161-169.

Birch, Herbert G. and Arthur Lefford. "Intersensory Development in Children," Monograph of Society for Research in Child Development, 28 (5), Serial No. 80, 1963, pp. 1-48.

Daniel, Patricia N. and Robert S. Tacker. "Preferred Modality of Stimulus Input and Memory for CVC Trigrams," The Journal of Educational Research, 67 (6), February, 1974, pp. 255-258.

Edwards, Allen L. Experimental Design in Psychological Research, Atlanta: Holt, Rinehart and Winston, Inc., 1972.

Farrald, Robert R. and Richard G. Schamber. Handbook 1: A Mainstreaming Approach to Identification, Assessment and Amelioration of Learning Disabilities, Sioux Fall, South Dakota: ADAPT Press, 1973.

Farr, Beatrice J. Individual Differences in Learning: Predicting One's More Effective Learning Modality, unpublished Doctoral dissertation, 1971.

French, Russell L. Teaching Strategies and Learning, unpublished paper, Department of Curriculum and Instruction, the University of Tennessee, Knoxville, 1975.

French, Russell L. Teaching Style and Instructional Strategies, unpublished paper, Department of Curriculum and Instruction, the University of Tennessess, Knoxville, 1975.

Hirsch, Jerry. "Individual Differences in Behavior and Their Genetic Basis," Roots of Behavior, Eugene L. Bliss, Editor, New York: Harper and Brothers, 1962.

Howes, Virgil M. Individualization of Instruction, New York: Macmillan Publishing Company, Inc., 1970.

Huck, Schuyler W., William H. Cormier, and William G. Bounds. Reading Statistics and Research, New York: Harper and Row Publishers, 1974.

Kirk, Roger E. Experimental Design Procedures for the Behavioral Sciences, Belmont, California: Brooks/Cole Publishing Company, 1968.

Mills, Robert E. "An Evaluation of Techniques for Teaching Word Recognition," The Elementary School Journal, January, 1956, pp. 221-225.

Riessman, Frank. "The Strategy of Style," Teachers College Record, 65 (6), March, 1964, pp. 484-489.

Rohwer, William D., Jr., and Mary Sue Ammon. "Population Differences and Learning Proficiency," Journal of Educational Psychology, 62 (1), 1971, pp. 1-14.

Smith, Vernon H. Alternative Schools, Lincoln, Nebraska: Professional Educators Publications, Inc., 1974.

Taylor, Calvin W. "Multiple Talent Teaching," Today's Education. March-April, 1974, pp. 71-74.

Travers, John F. Learning: Analysis and Application, New York: David McKay Co., Inc., 1965.

Wahlberg, Sharon A. A Study of Learning Modes of First Year School Children, unpublished Doctoral dissertation, 1971.

Woodrow, Herbert. "The Ability to Learn," Psychological Review, 53 1946, pp. 147-158.